Acquisition of non-linear kinetics from linear relations: application on lipolysis reactions and other potential functional food ingredient processes

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Esterification, lipolysis and transesterification are important types of reactions in food chemistry and the production of biodiesel. A key point for these reactions is their kinetics, used in reactor simulations to (1) describe pilot plant facilities or larger scale industrial reactors and to (2) optimize the output, i.e., to improve selectivities of desired products. However, a significant drawback of the corresponding kinetics is the non-linear behaviour and the need for sophisticated software to obtain them from experimental laboratory data. This research proposes a fast and easy method to determine kinetic parameters in systems with non-linear concentration dependencies via semi-batch operation of a laboratory continuous stirred tank reactor. The key idea is that while the net production rates are linear in the kinetic parameters, in general non-linearity is found in the concentration dependencies. If the experimental set-up is chosen in such a way that the acquired data allow the discarding of the given time dependency of the concentrations, an algebraic linear system of equations is obtained. Since linear dependencies are derived, the solution is trivially found, because it does not depend on the initial guesses of the kinetic parameters. Moreover, simple software like Excel, accessible to everybody, can be used to this extent. Transesterification reactions, applied to obtain biodiesel from triglycerides, are taken as a worked out example. Other types of reactions in potential functional food ingredients production processes can be described in an analogous way without any changes in the given procedure.